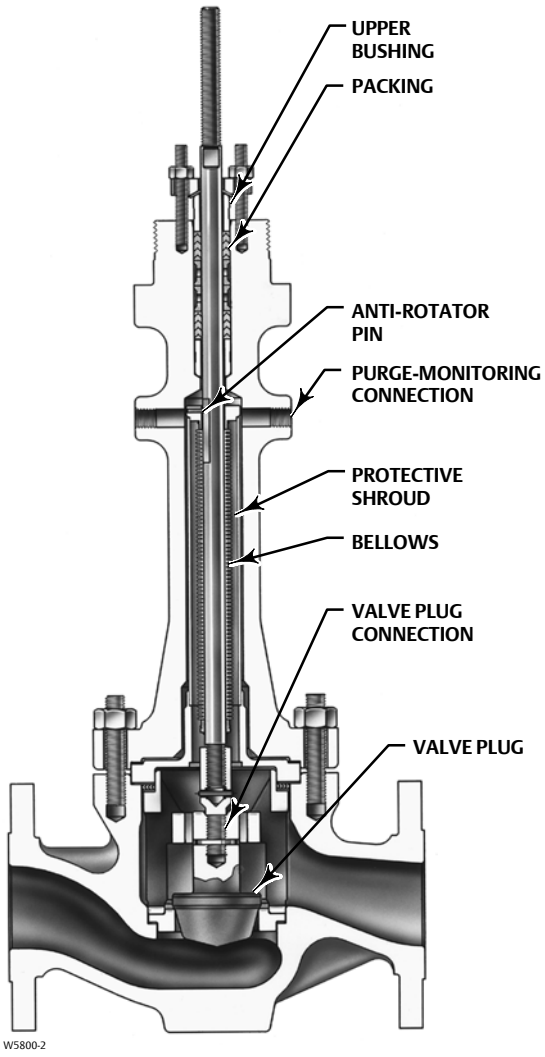
Fisher® ENVIRO-SEAL™ Bellows Seal Bonnets

ENVIRO-SEAL bellows seal bonnets improve sealing capabilities of Fisher valves and provide long life for applications where emissions escaping from a valve stem seal to the atmosphere cannot be tolerated. This excellent stem sealing system is available for Fisher easy-e™ valves (see the specifications table for information on valve designs and sizes).

Corrosion resistance is excellent--the bellows is available in either N06625 or N06022, and the bellows is protected against direct impingement by the flow stream. The mechanically formed bellows provides high operating reliability and extended cycle life, and the large annular area around the bellows optimizes warming by the process fluid.



ENVIRO-SEAL Bellows Detail (Mounted on easy-e VALVE)

Features

- **Excellent Sealing Capabilities are Factory Tested—**Every bellows seal is tested before leaving the factory. Each bellows is mass spectrometer tested to 1 X 10^{-6} cubic centimeters per second of helium.
- **Long Cycle Life—**Cycle lives in excess of those shown in tables 1, 2, 3, and 4 can be achieved with proper use and maintenance.
- **Easy Installation in Existing Valves—**All parts needed to install the system in existing valves are available in a convenient kit.
- **Rugged Construction—**An anti-rotator pin helps prevent accidental twisting and subsequent damage and helps prevent stem blow out. A full-length shroud protects the bellows against damage during handling, inspection, or maintenance. See the following figure.
- **Purging/Monitoring Connections are Standard—**Two connections above the bellows allow for purging or monitoring of bellows integrity.

Specifications

Applicable Valve Designs

NPS 1/2 through 4 Fisher CL125 through 600 ■easy-e valves (for example, EAT, EZ, ETR, etc.),■YD, and ■YS valves

Cycle Life

See tables 1, 2, 3, and 4 and the Cycle Life section. The bellows is available in ■one-ply or ■two-ply construction for higher pressures and longer cycle life

Pressures and Temperatures(1)

See tables 5 and 6. Do not exceed the pressure-temperature rating of the valve or the maximum temperature of the packing and gaskets

Factory Testing Specification

Every bellows is tested to 1 X 10^{-6} cubic centimeters per second of helium

Bellows Seal Travel (Also See Cycle Life Section)

See table 7

Construction Materials

See table 10

Material Temperature Capabilities(1)

Standard Packing:

Material	In-Body Process Temperature Limits(2)	Temperature Limits of the Packing Material
PTFE and PTFE/ Composition	-46 to 427°C (-50 to 800°F)	-40 to 232°C (-40 to 450°F)
Graphite Ribbon/ Filament	-46 to 593°C (-50 to 1100°F)	-18 to 538°C(3) (0 to 1000°F(3))

ENVIRO-SEAL Packing: See Bulletin 59.1:061 ENVIRO-SEAL Packing Systems for Sliding-Stem Valves
Bellows Gasket: Graphite Laminate
-254 to 593°C (-425 to 1100°F)
Valve Components: See the valve bulletin

Applicable Stem and Yoke Boss Diameters

See table 11

Maximum Flow Coefficients

See table 7

Bellows Spring Rate

Negligible for actuator sizing and selection purposes

Bellows Effective Area

When sizing an actuator, use the bellows effective area instead of the valve stem area
NPS 1/2 through 2 Valves: 2.28 cm^2 (0.353 square inches)
NPS 3 and 4 Valves: 8.65 cm^2 (1.340 square inches)

Dimensions

See figure 2

Options

■Retrofit kits for installation in existing valves.
■ENVIRO-SEAL packing systems (figure 1) with PTFE, Graphite ULF, or Duplex packing materials; see Bulletin 59.1:061

1. The pressure-temperature limits in this bulletin, in the valve bulletin, and any applicable code or standard limitation, should not be exceeded.
2. These in-body process temperatures assume an outside, ambient temperature of 21°C (70°F).
3. Limit to 371°C (700°F) on oxidizing service.

Cycle Life

Bellows seal service life is affected by several factors, including pressure, temperature, and travel. The cycle life values listed in tables 1, 2, 3, and 4 are determined from experimental data and reflect a 99% confidence factor. These cycle life estimates do not include effects from vibration in the piping system.

ENVIRO-SEAL bellows are normally sold with the travel limited for optimum cycle life performance. Bellows may be operated at full valve travel at reduced cycle life.

Table 1. Estimated Cycle Life for N06625 Bellows(1) at 10.3 Bar (150 Psig) and 38°C (100°F)

VALVE SIZE, NPS		BELLOWS SEAL TRAVEL											
1/2, 3/4, 1, & 1-1/2		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		3.6	0.14	4.6	0.19	6.4	0.28	9.7	0.38	14.2	0.56	19.1	0.75
	1 Ply	8,000,000		4,000,000		1,400,000		550,000		150,000		50,000	
	2 Ply	10,000,000		10,000,000		2,300,000		800,000		160,000		50,000	
2		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		5.3	0.21	7.1	0.28	10.7	0.42	14.2	0.56	22.2	0.88	28.6	1.12
	1 Ply	8,000,000		4,000,000		1,400,000		550,000		150,000		50,000	
	2 Ply	10,000,000		10,000,000		2,300,000		800,000		160,000		50,000	
3		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		6.4	0.28	9.5	0.38	26.0	0.56	19.1	0.75	28.6	1.12	38.1	1.50
	1 Ply	1,000,000		1,000,000		700,000		450,000		300,000		100,000	
	2 Ply	10,000,000		10,000,000		5,000,000		2,500,000		1,000,000		350,000	
4		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		9.5	0.38	12.7	0.5	19.1	0.75	28.6	1.12	38.1	1.50	50.8	2.00
	1 Ply	1,000,000		700,000		450,000		300,000		100,000		50,000	
	2 Ply	10,000,000		5,000,000		2,500,000		1,000,000		350,000		150,000	

1. See the Cycle Life section in this bulletin for more information on bellows travel.

Table 2. Estimated Cycle Life for N06625 Bellows(1) at Maximum Pressure and 316°C (600°F)

VALVE SIZE, NPS		BELLOWS SEAL TRAVEL											
1/2, 3/4, 1, & 1-1/2		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		3.6	0.14	4.6	0.19	6.4	0.28	9.7	0.38	14.2	0.56	19.1	0.75
	1 Ply	100,000		80,000		50,000		30,000		12,000		7,000	
	2 Ply	100,000		90,000		50,000		30,000		12,000		7,000	
2		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		5.3	0.21	7.1	0.28	10.7	0.42	14.2	0.56	22.2	0.88	28.6	1.12
	1 Ply	100,000		80,000		50,000		30,000		12,000		7,000	
	2 Ply	100,000		90,000		50,000		30,000		12,000		7,000	
3		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		6.4	0.28	9.5	0.38	26.0	0.56	19.1	0.75	28.6	1.12	38.1	1.50
	1 Ply	45,000		45,000		34,000		24,000		18,000		12,000	
	2 Ply	50,000		50,000		41,000		34,000		24,000		12,000	
4		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		9.5	0.38	12.7	0.5	19.1	0.75	28.6	1.12	38.1	1.50	50.8	2.00
	1 Ply	45,000		34,000		24,000		18,000		12,000		7,000	
	2 Ply	50,000		41,000		34,000		24,000		12,000		7,000	

1. See the Cycle Life section in this bulletin for more information on bellows travel.

Table 3. Estimated Cycle Life for N06022 Bellows(1) at 10.3 Bar (150 Psig) and 38°C (100°F)

VALVE SIZE, NPS		BELLOWS SEAL TRAVEL											
1/2, 3/4, 1, & 1-1/2		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		3.6	0.14	4.6	0.19	6.4	0.28	9.7	0.38	14.2	0.56	19.1	0.75
	1 Ply	8,000,000		4,000,000		1,200,000		500,000		110,000		40,000	
	2 Ply	10,000,000		10,000,000		2,000,000		650,000		140,000		40,000	
2		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		5.3	0.21	7.1	0.28	10.7	0.42	14.2	0.56	22.2	0.88	28.6	1.12
	1 Ply	8,000,000		4,000,000		1,200,000		500,000		110,000		40,000	
	2 Ply	10,000,000		10,000,000		2,000,000		650,000		140,000		40,000	
3		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		6.4	0.28	9.5	0.38	26.0	0.56	19.1	0.75	28.6	1.12	38.1	1.50
	1 Ply	1,000,000		1,000,000		700,000		450,000		300,000		100,000	
	2 Ply	10,000,000		10,000,000		5,000,000		2,000,000		900,000		300,000	
4		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		9.5	0.38	12.7	0.5	19.1	0.75	28.6	1.12	38.1	1.50	50.8	2.00
	1 Ply	1,000,000		700,000		450,000		300,000		100,000		50,000	
	2 Ply	10,000,000		5,000,000		2,000,000		900,000		300,000		130,000	

1. See the Cycle Life section in this bulletin for more information on bellows travel.

Table 4. Estimated Cycle Life for N06022 Bellows(1) at Maximum Pressure and 316°C (600°F)

VALVE SIZE, NPS		BELLOWS SEAL TRAVEL											
1/2, 3/4, 1, & 1-1/2		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		3.6	0.14	4.6	0.19	6.4	0.28	9.7	0.38	14.2	0.56	19.1	0.75
	1 Ply	90,000		80,000		50,000		30,000		12,000		6,000	
	2 Ply	100,000		90,000		50,000		30,000		12,000		6,000	
2		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		5.3	0.21	7.1	0.28	10.7	0.42	14.2	0.56	22.2	0.88	28.6	1.12
	1 Ply	90,000		80,000		50,000		30,000		12,000		6,000	
	2 Ply	100,000		90,000		50,000		30,000		12,000		6,000	
3		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		6.4	0.28	9.5	0.38	26.0	0.56	19.1	0.75	28.6	1.12	38.1	1.50
	1 Ply	40,000		40,000		34,000		24,000		18,000		12,000	
	2 Ply	50,000		50,000		40,000		31,000		23,000		12,000	
4		mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
		9.5	0.38	12.7	0.5	19.1	0.75	28.6	1.12	38.1	1.50	50.8	2.00
	1 Ply	40,000		34,000		24,000		18,000		12,000		7,000	
	2 Ply	50,000		40,000		31,000		23,000		12,000		7,000	

1. See the Cycle Life section in this bulletin for more information on bellows travel.

Table 5. Pressure-Temperature Rating for N06625 Bellows

VALVE SIZE, NPS	PRESSURE, BAR								
	Temp., °C	38	93	149	204	260	316	371	427
1/2, 3/4, 1, 1-1/2, and 2	1 Ply	37.9	34.9	33.0	31.1	29.6	28.5	17.1	27.3
	2 Ply	68.9	63.4	60.0	56.5	53.8	51.7	50.3	49.6
3 & 4	1 Ply	23.9	21.6	20.4	19.2	18.3	17.6	17.1	16.9
	2 Ply	43.1	39.6	37.5	35.3	33.6	32.3	31.4	31.0
VALVE SIZE, NPS	**PRESSURE, PSIG**								
	Temp., °F	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**800**
1/2, 3/4, 1, 1-1/2, and 2	1 Ply	550	506	479	451	429	413	402	396
	2 Ply	1000	920	870	820	780	750	730	720
3 & 4	1 Ply	346	313	296	279	265	255	248	245
	2 Ply	625	575	544	512	488	469	456	450

Table 6. Pressure-Temperature Rating for N06022 Bellows

VALVE SIZE, NPS	PRESSURE, BAR								
	Temp., °C	38	93	149	204	260	316	371	427
1/2, 3/4, 1, 1-1/2, and 2	1 Ply	37.9	36.8	36.0	34.9	33.4	32.6	31.5	30.3
	2 Ply	68.9	66.8	65.5	63.4	60.6	59.3	57.2	55.1
3 & 4	1 Ply	23.9	22.7	22.3	21.6	20.6	20.1	19.4	18.7
	2 Ply	43.1	41.8	40.9	39.6	37.9	37.0	35.8	34.5
VALVE SIZE, NPS	**PRESSURE, PSIG**								
	Temp., °F	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**800**
1/2, 3/4, 1, 1-1/2, and 2	1 Ply	550	534	523	506	484	473	457	440
	2 Ply	1000	970	950	920	880	860	830	800
3 & 4	1 Ply	340	330	323	313	299	292	282	272
	2 Ply	625	606	594	575	550	537	519	500

Figure 1. Typical ENVIRO-SEAL Packing Systems

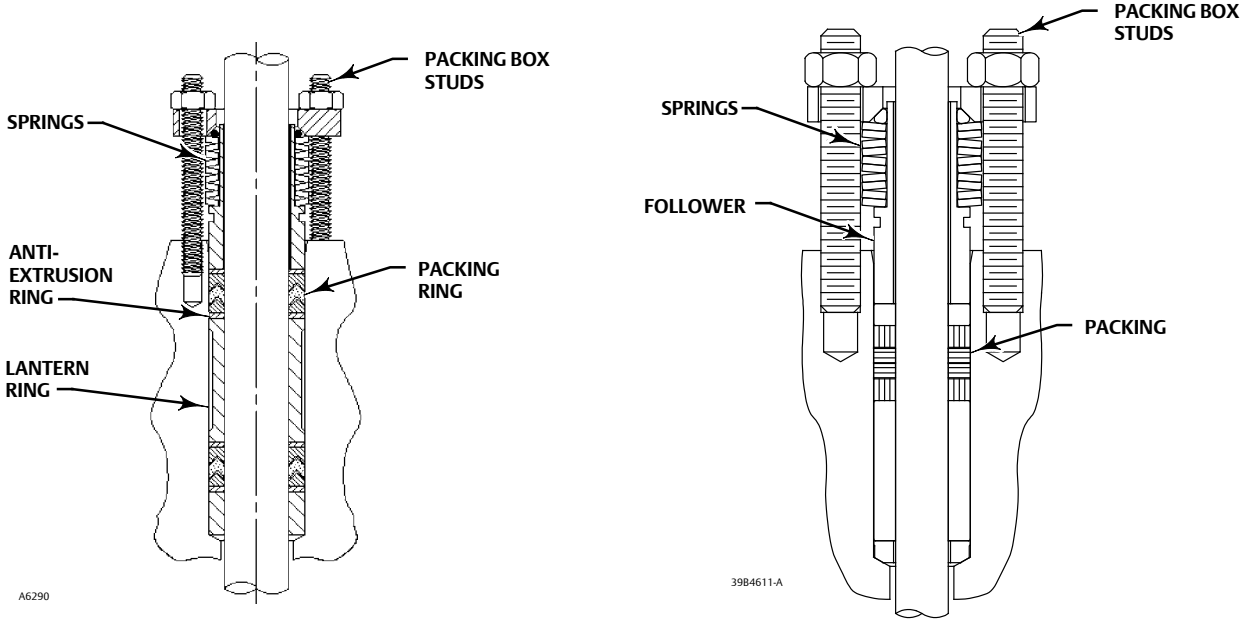


Table 7. Flow Coefficients with ENVIRO-SEAL Bellows Seal and easy-e Valves

VALVE DESIGN	VALVE SIZE, NPS	BELLOWS SEAL TRAVEL		FULL-SIZE TRIM			RESTRICTED TRIM		
		mm	Inch	Quick Opening	Linear	Equal Percentage	Quick Opening	Linear	Equal Percentage
				C_v					
ED, EDR, ET, and ETR (Flow Down)	1	14.2	0.56	21.5	17.8	9.37	---	---	---
	1-1/2	14.2	0.56	40.4	32.5	21.0	26.8	22.5	11.1
	2	22.2(1)	0.88(1)	74.7	65.1	31.4	31.2	33.3	24.3
	3	28.6	1.125	152	126	81.5	91.9	102	70.7
	4	38.1(2)	1.50(2)	243	192	148	130	113	112
				C_g					
	1	14.2	0.56	641	559	325	---	---	---
	1-1/2	14.2	0.56	1300	1090	695	990	760	357
	2	22.2(1)	0.88(1)	2390	2130	1070	1120	1110	783
	3	28.6	1.125	4740	4130	2690	3170	3490	2370
	4	38.1(2)	1.50(2)	7990	6680	5000	4750	4220	4040
ES (Flow Up)				C_v					
	1/2	14.2	0.56	6.53	---	---	---	---	---
	3/4	14.2	0.56	14.2	---	---	---	---	---
	1	14.2	0.56	21.2	16.8	11.3	---	---	---
	1-1/2	14.2	0.56	38.0	28.4	20.4	30.0	19.5	10.0
	2	22.2(1)	0.88(1)	67.2	60.6	30.9	39.4	30.9	20.8
	3	28.6	1.125	140	117	73.1	115	88.8	67.5
	4	38.1(2)	1.50(2)	228	174	125	183	139	121
				C_g					
	1/2	14.2	0.56	206	---	---	---	---	---
	3/4	14.2	0.56	415	---	---	---	---	---
	1	14.2	0.56	688	565	367	---	---	---
	1.5	14.2	0.56	1325	967	679	992	659	334
	2	22.2(1)	0.88(1)	2410	2100	1090	1350	1050	710
	3	28.6	1.125	4780	4100	2540	3990	3060	2320
	4	38.1(2)	1.50(2)	8000	6170	4250	6280	4910	4230
EZ (Flow Up)				C_v					
	1/2	14.2	0.56	4.44	---	---	---	---	---
	3/4	14.2	0.56	9.72	---	---	---	---	---
	1	14.2	0.56	16.8	11.6	9.15	---	---	---
	1.5	14.2	0.56	33.6	27.5	13.1	19.0	12.0	10.0
	2	22.2(1)	0.88(1)	58.5	46.2	38.8	17.9	15.7	15.9
	3	28.6	1.125	127	93.4	73.4	88.4	80.4	71.5
	4	38.1(2)	1.50(2)	221	168	118	86.7	86.8	72.7
				C_g					
	1/2	14.2	0.56	168	---	---	---	---	---
	3/4	14.2	0.56	341	---	---	---	---	---
	1	14.2	0.56	475	375	299	---	---	---
	1-1/2	14.2	0.56	1250	921	417	727	380	302
	2	22.2(1)	0.88(1)	2140	1630	1330	687	599	605
	3	28.6	1.125	4490	3460	2400	3120	2783	2450
	4	38.1(2)	1.50(2)	7940	5860	3770	2910	2979	2570

Note: Bellows seal travel is 75% of maximum rated valve travel.
1. 19.1 mm (0.75 inch) travel for restricted trim.
2. 28.6 mm (1.125 inch) travel for restricted trim.

Table 8. Dimensions for easy-e Valves

VALVE SIZE, NPS	easy-e VALVES			
	Stem Diameter		D	
	mm	Inch	mm	Inch
1/2, 3/4, & 1	9.5	3/8	320	12.59
1-1/2	9.5	3/8	317	12.47
2	12.7	1/2	383	15.09
3	12.7	1/2	517	20.34
4	12.7	1/2	541	21.28

Table 9. Dimensions for easy-e Valves

VALVE STEM DIAMETER		ACTUATOR TYPE	ACTUATOR SIZE	E	
mm	Inch			mm	Inch
9.5	3/8	657	30	440	17.31
			34	498	19.62
		667	30	478	18.81
			34	573	22.56
12.7	1/2	657	40	548	21.56
			45	659	25.94
			46	656	25.81
		667	40	594	23.38
			45	768	30.25
			46	748	29.44

Ordering Information

When ordering, specify:

For Existing Valves

1. Process fluid
2. Process fluid temperature
3. Maximum valve inlet pressures
4. Maximum valve pressure drops
5. Valve design (ED, YD, etc.), size, and class
6. Valve stem diameter
7. Refer to the specifications. Review the information under each specification and in the referenced tables; write down your choice whenever there is a selection to be made.

With New Valves

1. Refer to the valve bulletin for ordering information.
2. Also refer to the specifications. Review the information under each specification and in the referenced tables; write down your choice whenever there is a selection to be made.

Figure 2. Dimensions for easy-e Valves (also see tables 8 and 9)

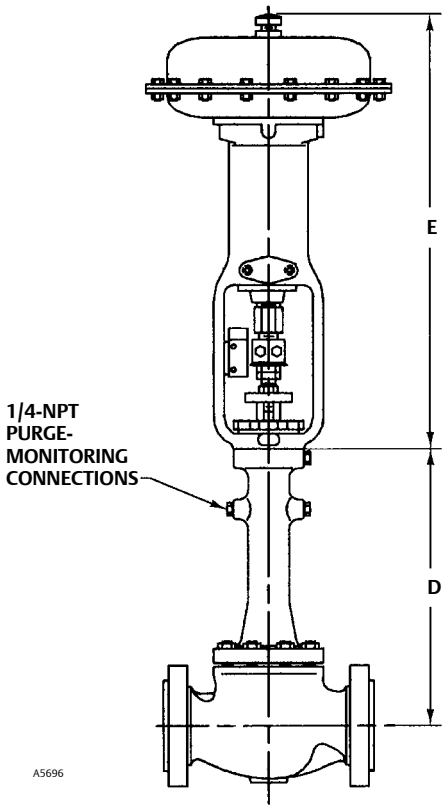


Table 10. Construction Materials

PART	easy-e VALVES
Bonnet	WCC steel or CF3M (316L stainless steel)
Bellows Seal Assembly (Bellows / Other Wetted Parts)	N06625 / S31603 (316L stainless steel) or N06022 / N06022
Upper Bushing	S31600 (316 stainless steel), R30006, Chrome-coated S31600, PTFE-lined S31600, or N10276/PTFE-glass
Bonnet Gaskets	Graphite laminate/stainless steel
Packing	PTFE V-ring, PTFE/composition, graphite ribbon/filament, or PTFE or ENVIRO-SEAL Graphite ULF packing system
Packing Box Ring and Lantern Ring	S31600 (316 stainless steel) or N10276
Packing Flange, Studs, and Nuts	Steel, 316 stainless steel, or N10276
Valve Components	See valve bulletin

Table 11. Applicable Yoke Boss and Stem Diameters

VALVE SIZE, NPS	easy-e VALVES					
	Yoke Boss Diameter		Stem Thread Diameter(1)		Valve Stem Diameter(2)	
	mm	Inch	mm	Inch	mm	Inch
1/2, 3/4, 1, & 1-1/2	54	2-1/8	9.5	3/8	12.7	1/2
2	71	2-13/16	12.7	1/2	12.7	1/2
3 & 4	71	2-13/16	12.7	1/2	25.4	1

1. This is the diameter at the actuator stem connector.
2. This is the diameter where the stem passes through the packing.

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